

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

Listing of Claims:

Claim 1 (previously presented): A method for recording digital data codes representative of pieces of data information and asynchronously produced at irregular intervals in an information storage medium, comprising the steps of:

a) supplementing synchronous data codes representative of information which is meaningless with respect to definitions of said pieces of data information in said irregular intervals among said digital data codes for producing a continuous data stream so that each of said digital data codes is contiguous to another of said digital data codes or one of said synchronous data codes;

b) converting said digital data codes and said synchronous data codes of said continuous data stream to an analog data signal storing said pieces of data information and the meaningless information through a differential phase shift keying, and

c) recording said pieces of data information and the meaningless information in an information storage medium.

Claim 2 (previously presented): The method as set forth in claim 1, in which said step a) includes the sub-steps of

a-1) checking said digital data codes to see whether or not any one of said digital data codes is identical in bit string with each synchronous data code,

a-2) changing the bit string of said any one of said digital data codes to another bit string different from the bit string of said synchronous data codes and the bit strings of others of said digital data codes representative of pieces of data information different from the piece of data information represented by said any one of said data information when the answer at said sub-step a-1) is given affirmative,

a-3) unchanging the bit string of said any one of said digital data codes without execution of said sub-step a-2) when the answer at said sub-step a-1) is given negative,

a-4) repeating said sub-steps a-2) and a-3) for said others of said digital data codes, and

a-5) inserting said synchronous data codes in said irregular intervals among said digital data codes for producing said continuous data stream.

Claim 3 (original): The method as set forth in claim 1, in which said step b) includes the sub-steps of

b-1) converting said digital data codes and said synchronous data codes to gray codes representative of relative phases,

b-2) producing angular data codes representative of absolute values from said gray codes, and

b-3) converting said angular data codes to said analog data code through a quadrature modulation.

Claim 4 (original): The method as set forth in claim 3, in which said gray codes are accumulated so as to produce said angular data codes in said sub-step b-2).

Claim 5 (original): The method as set forth in claim 1, in which said step c) includes the sub-steps of

c-1) converting said analog data signal to a digital data signal through a pulse code modulation, and

c-2) driving a recording head for writing said digital data signal in said information storage medium.

Claim 6 (original): The method as set forth in claim 1, in which said digital data codes are broken down into sets of digital data codes representative of a performance of a tune on a musical instrument.

Claim 7 (original): The method as set forth in claim 6, in which said sets of digital data codes are representative of messages defined in the MIDI (Musical Instrument Digital Interface) standards.

Claim 8 (original): The method as set forth in claim 7, in which each of said digital data codes and each of said synchronous data codes have a data length equal to 4 bits, and sixteen relative angular positions are selectively assigned to said digital data codes and said synchronous data codes before a modulation to said analog data signal in said step b).

Claim 9 (original): The method as set forth in claim 8, in which said modulation is a quadrature modulation.

Claim 10 (original): The method as set forth in claim 8, in which the relative angular position assigned to said synchronous data codes are different from zero.

Claim 11 (previously presented): A recording apparatus for recording digital data codes representative of pieces of data information and asynchronously produced at irregular intervals in an information storage medium, comprising:

a data converting unit supplied with said digital data codes, and supplementing synchronous data codes representative of information which is meaningless with respect to definitions of said pieces of data information into said irregular intervals among said digital data codes for producing a continuous data stream so that each of said digital data codes is contiguous to another of said digital data codes or one of said synchronous data codes; and

a signal modulation unit connected to said data converting unit, and producing an analog data signal representative of said pieces of data information and the meaningless information from said continuous data stream through a differential phase shift keying.

Claim 12 (previously presented): The recording apparatus as set forth in claim 11, in which said data converting unit includes

a table for storing a relation between bit strings of certain digital data codes selected from said digital data codes and alternative bit strings different from a bit string of said synchronous data codes and bit strings of the others of said digital data codes,

a first data converter connected to said table and changing said certain digital data codes from said bit strings to said alternative bit strings and passing said others of said digital data codes without any change of bit string, and

a second data converter connected to said first data converter and inserting said synchronous data codes into said irregular intervals for producing said continuous data stream.

Claim 13 (original): The recording apparatus as set forth in claim 11, in which said signal modulation unit includes

a digital code-to-absolute phase converter connected to said data converting unit and producing angular data codes representative of absolute phases, and

a modulator connected to said digital code-to-absolute phase converter and producing said analog data signal through a quadrature modulation technique.

Claim 14 (original): The recording apparatus as set forth in claim 13, in which said digital code-to-absolute phase converter includes

a data converter connected to said data converting unit and converting said digital data codes and said synchronous data codes to gray codes representative of relative phases, and

an accumulator connected to said data converter and accumulating said gray codes for producing said angular data codes.

Claim 15 (original): The recording apparatus as set forth in claim 14, in which said data converter assigns one of said relative phases different from zero to said synchronous data codes.

Claim 16 (previously presented): The recording apparatus as set forth in claim 11, further comprising a write-in unit responsive to said analog data signal for recording said pieces of data information and the meaningless information in an information storage medium.

Claim 17 (previously presented): The recording apparatus as set forth in claim 16, in which said write-in unit converts said analog data signal to a digital data signal, and drives a recording head for writing said pieces of data information and the meaningless information in said information storage medium.

Claim 18 (original): The recording apparatus as set forth in claim 17, in which said write-in unit converts said analog data signal to said digital data signal through a pulse code modulation.

Claim 19 (previously presented): The recording apparatus as set forth in claim 16, in which said data converting unit includes

a table for storing a relation between bit strings of certain digital data codes selected from said digital data codes and alternative bit strings different from a bit string of said synchronous data codes and bit strings of the others of said digital data codes,

a first data converter connected to said table and changing said certain digital data codes from said bit strings to said alternative bit strings and passing said others of said digital data codes without any change of bit string, and

a second data converter connected to said first data converter and inserting said synchronous data codes into said irregular intervals for producing said continuous data stream.

Claim 20 (original): The recording apparatus as set forth in claim 16, in which said signal modulation unit includes

a digital code-to-absolute phase converter connected to said data converting unit and producing angular data codes representative of absolute phases, and

a modulator connected to said digital code-to-absolute phase converter and producing said analog data signal through a quadrature modulation technique.

Claim 21 (original): The recording apparatus as set forth in claim 20, in which said digital code-to-absolute phase converter includes

a data converter connected to said data converting unit and converting said digital data codes and said synchronous data codes to gray codes representative of relative phases, and

an accumulator connected to said data converter and accumulating said gray codes for producing said angular data codes.

Claim 22 (original): The recording apparatus as set forth in claim 21, in which said data converter assigns one of said relative phases different from zero to said synchronous data codes.

Claim 23 (original): The recording apparatus as set forth in claim 11, in which said digital data codes are broken down into sets of digital data codes representative of a performance of a tune on a musical instrument.

Claim 24 (original): The recording apparatus as set forth in claim 23, in which said sets of digital data codes are representative of messages defined in the MIDI (Musical Instrument Digital Interface) standards.

Claim 25 (original): The recording apparatus as set forth in claim 23, in which each of said digital data codes and each of said synchronous data codes have a data length equal to 4 bits, and said signal modulating unit selectively assigns sixteen relative angular positions to said digital data codes and said synchronous data codes before a modulation to said analog data signal.

Claim 26 (original): The recording apparatus as set forth in claim 25, in which said modulation is a quadrature modulation.

Claim 27 (original): The recording apparatus as set forth in claim 25, in which the relative angular position assigned to said synchronous data codes is different from zero.

Claim 28 (currently amended): An information storage medium having a plurality of recording channels partially ~~used for recording~~ occupied by pieces of data information represented by digital data codes asynchronously produced at irregular intervals and pieces of information which is meaningless with respect to definitions of said pieces of data information and represented by synchronous data codes, said synchronous data codes supplemented into said irregular intervals among said digital data codes for producing a continuous data stream so that each of said digital data codes is contiguous to another of said digital data codes or one of said synchronous data codes and partially ~~for~~ occupied by other pieces of data information represented by a data signal.

Claim 29 (currently amended): The information storage medium as set forth in claim 28, in which said plurality of recording channels are made of a material that is opto-magnetically changed by the recording of said pieces of data information, said pieces of meaningless information and said other pieces of data information ~~are opto-magnetically recorded in said plurality of recording channels.~~

Claims 30-37 (canceled)

Claim 38 (previously presented): A method for recording digital data codes representative of pieces of music data information and asynchronously produced at irregular intervals in an information storage medium, said digital data codes having a format capable of representing more than two values, comprising the steps of:

- a) converting digital data codes to an analog signal carrying said pieces of music data information through a modulation technique assigning values of said digital data codes to values of a physical quantity periodically varied;
- b) recording said pieces of music data information in said analog signal into an information storage medium.

Claim 39 (currently amended): The method as set forth in claim 38, in which said step a) includes the sub-steps of

a-1) supplementing synchronous data codes representative of information which is meaningless with respect to ~~meaninglessness from the aspect of~~ definitions of said pieces of data information in said irregular intervals for producing a data stream, and

a-2) converting said digital data codes and said synchronous data codes to said analog data signal carrying said pieces of data information and ~~said meaninglessness~~ the meaningless information.

Claim 40 (original): The method as set forth in claim 38, in which said modulation technique is a differential phase shift keying.

Claim 41 (previously presented): A recording apparatus for recording digital data codes representative of pieces of music data information and asynchronously produced at irregular intervals in an information storage medium, each of said digital data codes having a format capable of representing more than two values, comprising:

an analog audio signal producing circuit supplied with said digital data codes, and producing an analog audio signal carrying said pieces of music data information through a modulating technique assigning values of said digital data codes to values of a physical quantity periodically varied; and

a recording circuit connected to said analog audio signal producing circuit for storing said pieces of music data information carried on said analog audio signal in an information storage medium.

Claim 42 (currently amended): The recording apparatus as set forth in claim 41, in which said analog audio signal producing circuit includes

a data converting unit supplied with said digital data codes and supplementing synchronous data codes representative of information which is meaningless with respect to ~~meaninglessness from the aspect of~~ definitions of said pieces of data information into said irregular intervals among said digital data codes for producing a data stream, and

a signal modulation unit connected to said data converting unit and producing an analog data signal representative of said pieces of data information and the meaningless information said ~~meaninglessness~~ from said data stream through said modulation technique.

Claim 43 (original): The recording apparatus as set forth in claim 42, in which said modulation technique is a differential phase shift keying.